

served in the Upper Cretaceous beds of Southern France and the *Hemipneustes* beds of Baluchistán. This seems to point to similar physical conditions under which the Upper Cretaceous beds were deposited in South-western France and Baluchistán. Another most remarkable fact is that the *Hemipneustes* beds do not share a single specimen with the Upper Cretaceous beds of Palestine and North Africa. It may be doubtful whether strata of the age of the *Hemipneustes* beds are developed in Palestine; but they certainly occur in North Africa.

"These considerations lead us to the conclusion that the *Hemipneustes* beds are of Upper Senonian age, and most probably represent the étage Maëstrichtien. The fauna therein contained bears hardly any resemblance to the fauna of similar age in Southern India or Northern Africa. On the other hand, it exhibits the closest relationship to the fauna contained in beds of similar age of South-western France. The fauna of the *Hemipneustes* beds must therefore be considered as belonging to the European province of the later Cretaceous sea, and living probably in close proximity to its eastern shores. This sea was most probably divided by a comparatively narrow land-barrier from the sea in which the Upper Cretaceous fauna of Southern India lived—a view first expressed by Dr. Blandford, and not, as I erroneously stated, by the late Professor Neumayr."

The 23 quarto plates supply good illustrations of seventy-nine Upper Cretaceous Baluchistán species, fully described as 3 Rhizopods, 3 Corals, 16 Echinoderms, 26 Pelecypods, 24 Gasteropods, 6 Cephalopods, and 1 Crustacean. The several generic facies remind us of some of the Lower Cretaceous, as well as of many of the Upper Cretaceous, forms of Western Europe.

The author is conscientiously careful in terminology and nomenclature, and is very correct in orthography; yet the modern confusion in the names of the Ammonoidea has entangled him, as usual with less educated writers, and allowed him to let slip a false concord in the specific name of *Indoceras* at several pages.

*Notes on the Morphology of the Pelecypoda.* By FRITZ NOETLING, Ph.D., F.G.S. *Palaontologia Indica.* New Series. Vol. I. Part 2. 57 pages, 4 plates (ii. to v.), and 8 cuts. Folio. 1899. Calcutta: Geol. Survey Office. London: Kegan Paul & Co.

AFTER dwelling on the insufficiency of the common method of describing the hinge-teeth of the Bivalved Molluscs (*Bivalvia*, Linné, *Acephala*, Cuvier, *Lamellibranchia*, Blainville, *Pelecypoda*, Goldfuss), which are here treated under the group-name given by Goldfuss, the author proceeds to illustrate and explain the well-based and philosophical system of terminology for these teeth as elaborated by Munier-Chalmas, Stefanescu, and Bernard, and founded on the development of the hinge. Although the homologies are as yet

imperfect, and suggestions may be made for improvement in the details, the eminent scientists have done good in opening up a vast field of research for conchologists. Dr. Noetling gives his reasons for preferring Prof. Bernard's system, and adopts it with some minor alterations. The following statements are nearly all in the author's own words.

The teeth have been evolved from primary lamellæ (that is, simple ridges) on the anterior and posterior side of the cardinal margin. The posterior primary lamellæ remained simple throughout the whole life, and no case is known in which secondary teeth originated from them; but whether originally or only subsequently, they are always anteriorly inclined (prosocline). The anterior primary lamellæ, however, indicate various changes at their posterior end by thickening and curving, which eventually resulted in the differentiation of the cardinal teeth. In the differentiated primary lamellæ the anterior laterals are always, and the anterior cardinals mostly, posteriorly inclined (opisthocline), while the posterior cardinals are always prosocline.

It is supposed that the anterior cardinal tooth was formed at the posterior end of the primary lamellæ, and by further growth the posterior cardinal was developed. This would prove that (1) the anterior and posterior laterals are the oldest teeth of the Bivalve shell, and should therefore be present in the geological oldest species; (2) the anterior cardinal was formed afterwards, and is therefore younger than the laterals, but older than the posterior cardinal; (3) the posterior cardinal was formed latest, and therefore must be regarded as the youngest of all the teeth: geologically old species could therefore have no posterior cardinal.

Of the several primary lamellæ those on the dorsal side of one another appear to be older than the ventral lamellæ, just as the ventral portion of a bivalve shell is younger than the dorsal part, according to the evident direction of growth in the shell.

This relative development of the dorsal primary lamellæ as older than the ventrals is evident in the hinge of *Pectunculus* and *Arca*, as given by Bernard, for the increase of lamellæ takes place at the ventral side of the first; and the more lamellæ which appear ventrally, the more the older lamellæ move directly and internally until they disappear entirely. Thus the ventral primary lamellæ are the youngest; and an increase of number takes place on the ventral and not on the dorsal side. Shells having a hinge resulting from the evolution of ventrally situated lamellæ would therefore represent a modern type; whilst others, in which the hinge has developed from the more dorsal lamellæ, represent a more archaic type.

Dr. Noetling states (page 9) that in examining the hinge of several Recent and Miocene genera, represented by 18 species (described at pages 9-57, and illustrated on plates ii. to v., with 35 figures and 4 diagrams), on the basis of MM. Munier-Chalmas and Bernard's methods, he has remarked some very noticeable features in the development of the hinge of the Pelecypoda.

The genera here described he classifies in three groups, as follows:—

- “I. The first group, including the genus *Cardita* and the family *Veneridae*, is distinguished by the reduction of the anterior and posterior laterals with regard to number and strength; on the other hand, the cardinals have strongly developed with regard to their thickness, though there is unquestionably a tendency towards the reduction of number by resorption of the posterior cardinals of higher order.
- “II. The second group comprises the genus *Maetra*. In this genus just the reverse takes place as in the first group; the anterior and posterior laterals are strongly developed with regard to number and strength; on the other hand, the cardinals are almost rudimentary, while their number is greatly reduced.
- “III. The third group is represented by the genus *Meiocardia*; in this genus laterals and cardinals are neither reduced in number, nor has the strength of one been increased at the expense of the other; the peculiar feature is that originally separate teeth, originating from different primary lamellæ, have become amalgamated and form composite teeth, which hardly allow their primary elements to be traced. An originally complex hinge has therefore become simplified not by disappearance of some of its elements, but by amalgamation of some of them, a feature which has not been noticed in either of the two preceding groups.”

An Appendix (pp. 44–57) on the Variability of Pelecypod Shells suggests a useful “Index” of numerical value, with the figure or formula  $L/H$  (length and height placed over the average measurement, thus— $L/H145$ ); and its application, especially with the graphical method of diagram, in which, the numerical values being grouped in a horizontal line, their heights can indicate the curve of variability in a given species (see plate v.).

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

March 12th, 1902.—Sir Archibald Geikie, D.C.L., LL.D., F.R.S.,  
Vice-President, in the Chair.

The following communication was read:—

‘On Proterozoic Gasteropoda which have been referred to *Murchisonia* and *Pleurotomaria*, with Descriptions of New Subgenera and Species.’ By Miss Jane Donald.

Many of the Palæozoic shells referred to *Murchisonia* do not agree with the type, and there are at least two separate groups distinguished by the outer lip. The typical group has a slit, the